On Future Solar Eclipses. By the Rev. S. S. Johnson.

The following list of eclipses was undertaken, in the first instance, for my own information and curiosity. Any investigation with regard to phenomena a vast number of years hence can only be a subject of mere curiosity; nevertheless, it may not be regarded as wholly uninteresting. If it be said to be needless to have continued the following examination to the end of the twenty-second century, I can only refer to the computations of the transits of *Venus*, of which Delambre has given a list for a period of two thousand years. I may therefore be excused for calling attention to the eclipses for only *three* centuries to come. The chief reason that induced me to do so was to endeavour to discover, if possible, when the next eclipse of the Sun will take place that will be total at London. Although it is now known what will be the date of this phenomenon for England, I believe no attempt has been made to find out when such will be the case at London. The eclipses of 1912 (in one work) and 1916 (in several works) have been referred to as satisfying the conditions. This is now known to be an error. When it is merely desired to *predict* an eclipse, the long and intricate calculations of the present day are not needed: it is enough to know the time approximately, and not to the nearest second. If expeditious tables could be found, giving the time to a few minutes, they would suffice. Such tables, I believe, I have discovered in those given in the eighth edition of the *Encyclopædia Britannica*. First of all, I tried a great number of *known* solar eclipses by them. In only one instance, that of May 26, 1873, have I found them more than nine minutes out in the time of the greatest obscuration, generally very near indeed, and the size of the eclipse has always been correct in every case I have tried. Amongst others, I tried the eclipse of 1140 by them, which was always thought to be total at London, according to Dr. Halley, until Mr. Hind published his computations in the summer of 1871. After computing by these tables in the *Encyclopædia*, I found, upon making a projection, that a crescent was uncovered at the south side of the Sun, showing the shadow must have gone to the north of London. This agreed with Mr. Hind's result. I therefore concluded that these tables would suffice for the purpose. I am not aware of any list of future eclipses extending over many years. In the *Mémoires* of the French Academy (1768) there is a paper by M. du Vaucel on all the solar eclipses visible at Paris from 1767 to 1900. This catalogue was computed from the tables of Mayer for the meridian of Paris, in order to gratify the French king, who was anxious to know whether a total or annular eclipse would happen soon. I have heard of Hallasckha's list of future eclipses, but do not know how far it extends. Beyond the limits of the present century but little mention has been made of eclipses. I do not, of course, forget Mr. Hind's communication to

the *Times*, last year, concerning the tracks of certain of them in the next century, and also of many in the remainder of the present. One he has omitted, that of May 28, 1900, which I believe is total in the south of Spain, and consequently the next occurring within easy distance from this country.* I have seen lists of eclipses to the end of the present century in two or three astronomical works. There was, therefore, no need to give them. I have, accordingly, commenced with the next. As to the main object I had in view—to discover, if possible, when the next total eclipse for London takes place—the eclipses of 2090 and 2151 seem both likely to satisfy the conditions, but in the former case totality takes place by these tables about $5^h 34^m$, or only about a quarter of an hour before sunset. Consequently I continued the computations into the following century. In the eclipse of June 14th, 2151, I believe London will be included within the belt of totality, to the southward of the central line.

Eclipses of the Twentieth Century.

The next very large solar eclipse takes place forty years hence, on April 17, 1912. This is a return of that which excited so much interest in 1858. The Moon's semidiameter does not quite equal the Sun's. At London only a narrow crescent on the upper part of the Sun's disk is left uncovered, soon after mid-day. There is another in 1961, but the greatest obscuration seems to take place close upon sunrise. That of 1999 Mr. Hind has shown to be total in the west of England. An eclipse on the morning of April 8th, 1921, is evidently annular in the northern parts of the kingdom, and consequently the next central eclipse we shall have in the British Isles. I have not seen this eclipse anywhere referred to. It will not be so large at London as that of 1912. The only other eclipse of any size occurs on June 30, 1954, but then less than nine-tenths of the Sun's upper limb are obscured at the metropolis about half-past twelve.*

I have expressed the size of each eclipse by the old method of digits, or twelfth parts of the Sun's surface. M. signifies morning, A. afternoon.

Date.	Greatest Obscuration.	Digits Eclipsed.
	h m	
1905, August 30 ..	about 1 4 A.	10
1908, June 28 ..	,, 5 40 A.	2
1912, April 17 ..	,, 0 25 A.	11
1914, August 21 ..	,, 11 57 M.	8
1916, February 3 ..	sets eclipsed.	
1919, November 22 ..	,,	
1920, ,, 10 ..	,,	

* That of 1887 can hardly be regarded, as occurring so near upon the time of sunrise.

There is a large eclipse in 1927, but I doubt its being total or annular anywhere.

Date.			Greatest Obscuration.	Digits Eclipsed.
			h m	
1921, April	8	..	about 8 53 M.	10
1922, March	28	..	,, 2 8 A.	2
1925, January	24	..	,, 3 50 A.	7
1927, June	29	..	,, 5 12 M.	11
1928, November	12	..	,, 8 28 M.	2
1929, ,,	1	..	,, 11 37 M.	1
1936, June	19	..	,, 4 15 M.	6
1939, April	19	..	,, 6 19 A.	4
1942, September	10	..	,, 4 20 A.	4
1945, July	9	..	,, 1 57 A.	7
1949, April	28	..	,, 7 29 M.	4
1952, February	24	..	,, 8 55 M.	1
1954, June	30	..	,, 0 28 A.	10
1959, October	2	..	,, 0 21 M.	4
1961, February	15	..	,, 7 28 M.	11
1966, May	20	..	,, 9 28 M.	6
1968, September	22	..	,, 10 15 M.	4
1971, February	25	..	,, 9 31 M.	7
1972, July	10	..	,, 8 3 A.	6
1973, December	24	..	sets before the middle.	
1975, May	11	..	about 6 29 M.	6
1976, April	29	..	,, 10 17 M.	4
1982, December	15	..	,, 8 16 M.	5
1984, May	30	..	,, 6 13 A.	5
1994, ,,	10	..	,, 6 45 A.	6
1996, October	12	..	,, 2 27 A.	7
1999, August	11	..	,, 10 8 M.	11

Eclipses of the Twenty-first Century.

Those of 2026 and 2081 appear to be total in France. That of 2093 is annular, and probably so at London; but the central line appears to run a little north of it. That of 2090 I have already alluded to. Column (1) shows date, (2) approximate hour of greatest obscuration, (3) digits, or twelfth part of the Sun's surface eclipsed.

(1)			(2) hour	(3)
2003, May	31	..	rises eclipsed.	
2005, October	3	..	$9\frac{1}{4}$ M.	7
2006, March	29	..	$10\frac{1}{4}$ M.	3
2008, August	1	..	9 M.	2
2011, January	4	..	sunrise	8
2015, March	20	..	$9\frac{1}{2}$ M.	10
2017, August	21	..	7 A.	2

(1)			(2) hour	(3)
2021, June	10	..	10½ M.	3
2025, March	29	..	11½ M.	4
2026, August	12	..	6 A.	11
2027, „	2	..	9 M.	5
2028, January	25	..	4¼ A.	7
2030, June	1	..	5¼ M.	7
2036, August	21	..	6 A.	8
2037, January	16	..	8¾ M.	7
2038, July	2	..	2 A.	1
2039, June	21	..	6½ A.	9
2048 „	11	..	1½ A.	9
2050, November	14	..	2 A.	9
2053, September	12	..	8¼ M.	7
2059, November	5	..	8 M.	9
2060, April	30	..	10¼ M.	2
2066, June	22	..	8¼ M.	9
2069, April	21	..	10 M.	4
2075, July	13	..	4¾ M.	10
2076, November	26	..	11 M.	5
2079, May	1	..	11 M.	5
2080, September	13	..	4¾ A.	9
2081, „	3	..	7½ M.	11
2082, February	27	..	4 A.	6
2088, April	21	..	10½ M.	6
2090, September	23	..	5½ A.	12
2091, February	18	..	10 M.	6
2092, „	6	..	4¼ A.	7
2093, July	23	..	0¼ A.	11

Eclipses of the Twenty-second Century.

For this century I find four very large eclipses. Those of 2135 and 2200 seem total in England north of London, but in the last instance the Moon's semidiameter does not much exceed the Sun's. The totality of that of 2142 will, I believe, go southward of this country. That of 2151, June 14, attains the greatest obscuration or totality at London, by these tables, about $6^h\,27^m$. The following are the approximate times of greatest obscuration :—

			hour
2135, October	7	.. ..	7¾ M.
2142, May	24	.. ..	8¾ M.
2151, June	14	.. ..	6½ A.
2200, April	14	.. ..	5¼ A.

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